

REMARKS

Claims 1, 2, 5, and 8-21 are presently pending in the application.

Claims 1 and 2 have been amended to recite that component (A) is selected from the group consisting of boron-modified bis-type polybutenyl succinimides, which is supported in the application at least at page 37, lines 2-3 and in formula (2) at page 9. Claims 1 and 2 have also been amended to recite that component (B) is selected from the group consisting of calcium carbonate-containing overbased calcium sulfonates and calcium carbonate-containing overbased calcium phenates, each having a base number of 250 to 500 mg KOH/g. Support for this amendment may be found in the specification at least at page 16, last 4 lines, page 17, lines 10-19, and page 37, lines 11-18. Finally, claims 1 and 2 now recite that the upper limit on the sulfated ash is 0.8 percent by mass, which is supported at least at page 31, lines 5-6.

Claims 3 and 6 have been canceled. Claims 9, 10, 17, and 19 recite the amount of Component (B), which is supported in the specification at least at page 18, lines 9-14. Claim 11 recites a calcium phenate of Component (B), which is supported at least at page 13, lines 18-22. Claims 12 and 13 recite specific Components (C) and (D), which are supported at least at page 20, lines 1-7, page 26, lines 14-16, and page 37, lines 19-22. Claims 14 and 15 are method claims, which are supported at least in claims 1 and 2 and in the specification at least at page 3, lines 13-20 and at page 5, lines 13-14. Support for claims 16 and 21 may be found at least at page 3, lines 13-20. New claim 18 is supported at least in claim 1 and at page 16, last 2 lines, page 17, lines 10-19, page 26, lines 14-16, and at page 31, lines 5-6. Finally, claim 20 is supported at least at page 5, lines 13-14. No new matter has been added by these amendments, and entry is respectfully requested.

In the Office Action, the Examiner has rejected claims 1-3, 5, 6, and 8 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,569,818 of Nakazato et al. ("Nakazato") in combination with U.S. Patent No. 5,064,546 of Dasai ("Dasai") or U.S. Patent No. 5,792,731 of Ichihashi ("Ichihashi"), and has rejected claims 1-3, 5, 6, and 9 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,306,801 of Yagishita et al. ("Yagishita") in view of Nakazato and Dasai or Ichihashi. Applicants respectfully traverse these rejections and the arguments in support thereof as follows, and respectfully request reconsideration and withdrawal of the rejections.

Rejection Under §103(a) Based on Nakazato in view of Dasai or Ichihashi

Regarding claims 1-3, 5, 6, and 8, the Examiner argues that Nakazato discloses a lubricating oil composition having a low phosphorus (P) content of 0.01 to 0.1 weight % and a sulfated ash content of 0.1 to 1 weight %, which is comprised of: (a) a major amount of mineral base oil having a low sulfur (S) content of at most 0.1 weight %, (b) an ashless alkenyl or alkyl-succinimide dispersant or derivative thereof in an amount of 0.01 to 0.3 weight % in terms of nitrogen atom content, (c) a metal-containing detergent such as an overbased alkaline earth metal salt of an alkyl salicylic acid in an amount of about 0.2 to 7 weight %, (d) a zinc dialkyl-dithiophosphate in an amount of 0.01 to 0.1 weight % in terms of a phosphorus content, and (e) an oxidation inhibitor. Nakazato allegedly teaches that the lubricating oil composition may be used in internal combustion engines such as diesel engines equipped with exhaust gas after treatment systems.

The Examiner argues that the open ended claim language in the present claims allows for the addition of other additives to the oil compositions, such as the oxidation inhibitor component of the prior art. Further, Nakazato allegedly teaches that the lubricating oil compositions may contain other auxiliary additives, such as phosphoric acid esters, phosphorous acid esters and organic amide compounds such as oleylamide.

The Examiner further argues that the claimed amine phosphite salts are known in the art as friction modifiers, as evidenced by Dasai, and as extreme pressure/anti-wear agents, as evidenced by Ichihashi. Specifically, the Examiner argues that Dasai teaches a lubricating oil composition comprising a base oil and from 0.01 to 5% by weight of a friction modifier which includes amine salts of phosphoric acid esters and amine salts of phosphorous acid esters which are represented by formulas (I), (II), and (III), phosphites are represented by formula (III), and that the amine salts include oleylamines. Ichihashi allegedly teaches a lubricant composition comprising a phosphorus-based extreme pressure additive which includes phosphite esters and phosphate esters and amine salts thereof.

Accordingly, the Examiner concludes that it would have been obvious to one having ordinary skill in the art at the time of the invention to have added the amine phosphite salt of Dasai or Ichihashi to the oil composition of Nakazato if the additive's known imparted properties were so desired. The Examiner takes the position that the results previously presented in the

Kurihara Declaration are not sufficient to overcome the *prima facie* case of obviousness since it would have been expected that differing anti-wear agents (phosphites and amine phosphate salts) would have differing results in anti-wear performance. Applicants respectfully traverse this rejection as follows.

The goal of the presently claimed invention is to provide a lubricating oil composition for an internal combustion engine, specifically, a low ash content-type engine oil suitable for use in diesel engines equipped with an exhaust-gas after treatment device, which can simultaneously provide enhanced anti-wear properties and good detergency at high temperature. Such properties are provided even when the lubricating oil composition has been contaminated with a large amount of soot. The presently claimed lubricating oil composition comprises (A) a boron-modified bis-type polybutenyl succinimide dispersant; (B) a specific overbased calcium sulfonate and/or phenate; (C) a zinc alkylthiophosphate; and (D) an amine phosphite salt of a phosphorous acid ester, and has a low ash content of from 0.3 to 0.8 mass %.

Nakazato teaches a low ash-content type engine oil composition comprising: (a) a mineral base oil, (b) an ashless succinimide dispersant, (c) a metal-containing detergent, (d) a zinc dialkyl-dithiophosphate, and (e) an oxidation inhibitor. Nakazato further teaches that the composition may contain phosphoric acid esters, phosphorous acid esters, and organic amide components, such as oleylamide. The metal-containing detergent (C) of Nakazato contains an organic acid metal salt which is selected from the group consisting of a non-sulfurized alkali metal or alkaline earth metal salt of an alkylsalicylic acid and a non-sulfurized alkali metal or alkaline earth metal salt of an alkylphenol derivative having a Mannich base structure as an essential component (col. 2, lines 58-64). Nakazato does not teach that Component (C) may be a specific overbased calcium sulfonate and/or phenate as claimed.

In fact, calcium sulfonates and calcium phenates are only included as the metal-containing detergent in *Comparative* Examples A-C of Nakazato (Detergents D, E, F, and H), as described at col. 12, line 45 to col. 13, line 33. As shown in the Table of Nakazato, these comparative compositions were inferior to those utilizing the specific metal detergents described in col. 2 of Nakazato, particularly in terms of Hot Tube test results. It can also be seen from considering Comparative Example A, which contains Detergent F (a calcium sulfonate), that the composition had a soap content of 0.1, outside of the appropriate range of 0.2 to 7 weight percent

taught by Nakazato in col. 3, lines 20-25. If Detergent E (a different calcium sulfoante) is used in place of Detergent F, the resulting soap content will also be less than the range taught by Nakazato. Accordingly, Nakazato teaches away from utilizing the claimed overbased calcium sulfonate and/or calcium phenate in place of the Nakazato metal detergent.

Accordingly, one skilled in the art reading Nakazato would not have been motivated to utilize the claimed detergents in order to attain excellent high temperature detergency, particularly since Nakazato shows that such detergents failed to provide the compositions with good performance in terms of detergency at high temperature.

The Examiner argues that Nakazato teaches that the lubricating oil compositions may contain other auxiliary additives, such as phosphoric acid ester, phosphorous acid esters and organic amide compounds such as oleylamide, and that Dasai and Ichihashi teach lubricating oil compositions comprising amine salts of phosphorous acid esters as friction modifiers and phosphite esters and phosphate esters and amine salts thereof as a phosphorus-based extreme pressure additives. However, Dasai and Ichihashi relate to lubricating oil compositions for use in automatic transmissions or continuously variable transmissions and do not teach the use of such compositions in internal combustion engines. Therefore, from the disclosures of Dasai and Ichihashi, one skilled in the art would not understand that anti-wear properties and detergency at high temperature in an engine cannot be achieved with reduced sulfated ash content, and thus would not have been motivated to combine the teachings of Nakazato, Dasai, and Ichihashi, as proposed by the Examiner.

Further, even such a proposed combination would not provide the claimed results, as shown in attached Table A, which summarizes several of the Nakazato compositions and those described in the present application. As shown in Table A, Comparative Examples 3 and 6 of the present application exhibited poor performance in anti-wear properties or detergency at high temperature. Comparative Examples 3, 4, and 6 of the present application are similar to Example 2 of Nakazato except that greater amounts of some components are included and Comparative Examples 3 and 6 further contain an amine phosphite. However, all of the Comparative Examples exhibited inferior properties in anti-wear performance or detergency at high temperature. Thus, even modification of the Nakazato compositions to include amine phosphites, as proposed by the Examiner, would not provide the favorable results exhibited by

the presently claimed invention, nor would such results have been expected based on the proposed modification.

For at least these reasons, even the proposed combinations of Nakazato with Dasai or Ichihashi would not teach or suggest all of the claimed elements, nor would the results exhibited by the presently claimed invention have been expected based on the proposed combinations. Reconsideration and withdrawal of the §103(a) rejection based on Nakazato in view of Dasai or Ichihashi are respectfully requested.

Rejection Under § 103(a) Based on Yagishita in view of Nakazato and Dasai or Ichihashi

Regarding claims 1-3, 5, 6, and 8, the Examiner argues that Yagishita discloses a lubricating oil composition suitable for use as a diesel engine oil which comprises a major amount of a lubricating base oil selected from mineral oils and synthetic oils and, as additives, (A) 0.5 to 20% by mass of acylated bisuccinimide, (B) 0.05 to 0.3 % by mass of zinc dithiophosphate in terms of phosphorus content, and (C) 0.5 to 3.0% by mass of metallic detergent in terms of sulfated ash content, based on the total mass of the composition. Yagishita allegedly teaches that the metallic detergent component may be an overbased alkaline earth metal salicylate having a total base number of 100 to 450 mg KOH/g. The Examiner acknowledged that Yagishita does not teach the addition of a phosphorus-containing ashless antiwear agent or adding a fatty acid amine to the lubricating oil compositions. However, the Examiner argues that Yagishita allows for the addition of known additives to the compositions, including antiwear agents.

Further, based on the alleged teachings of Nakazato described above, the Examiner argues that it would have been obvious for one skilled in the art to have added any conventional engine oil additives, such as those taught by Nakazato, to the lubricating oil compositions of Yagishita if the known imparted properties were so desired. The Examiner also takes the position that it would have been obvious to add the amine phosphite salts of Dasai or Ichihashi, to the oil composition of Yagishita if the additive's known imparted properties were so desired. The Examiner takes the position that the results previously presented in the Kurihara Declaration are not sufficient to overcome the *prima facie* case of obviousness since it would have been expected that differing anti-wear agents (phosphites and amine phosphate salts) would have

differing results in anti-wear performance. Applicants respectfully traverse this rejection as follows.

Yagishita discloses lubricating oil compositions suitable for use in diesel engines. These compositions contain a lubricating base oil, (A) 0.5 to 20% by mass of an acylated bissuccinimide, (B) 0.05 to 0.3 mass % of ZnDTP in terms of phosphorus content, and (C) 0.5 to 4.0 mass % of a metallic detergent in terms of a sulfated ash content, based on the total mass of the composition. Yagishita teaches that the use of an acylated bissuccinimide provides a lubricating oil composition having excellent sludge formation inhibiting effects. Yagishita does not teach or suggest the use of a boron-modified bis-type polybutenyl succinimide dispersant as claimed. In fact, a sample oil composition containing such a component is described in Comparative Example 5 of Yagishita (footnote 6 to Table 2 at col. 15, lines 41-43). Such a composition did not provide the intended sludge inhibiting performance provided by the inventive Yagishita compositions, and in fact, extremely large amounts of sludge formation were observed (col. 15, lines 55-60). Thus, Yagishita clearly teaches away from including the claimed bis-type polybutenyl succinimide.

Regarding sulfated ash content, Yagishita only teaches an amount of metal detergent to be used in terms of sulfated ash, but does not teach or suggest the sulfated ash content on the basis of the composition. In the Inventive and Comparative Examples, Yagishita uses a calcium carbonate-containing overbased calcium sulfonate (the claimed detergent) having a sulfated ash content of 42.5 mass % (see footnote 7 in Table 1 at col. 14, line 66 to col. 15, line 2). This is equivalent to an amount of detergent in terms of sulfated ash of 1.7 mass % ($42.5 \times 4/100$) based on the total amount of the composition, which considerably exceeds the claimed sulfated ash content of 0.4 to 0.8 mass %. There is no suggestion in Yagishita of reducing the sulfated ash content in the composition to 0.4 to 0.8 mass % as claimed.

Yagishita teaches that the compositions contain 0.5 to 40 % by mass of a metallic detergent in terms of sulfated ash content. As shown in the Table below, the amounts of the metal detergent used in Inventive Examples 2 and 3 of the present application are dramatically lower, 0.34 to 0.38 percent by mass.

Calculation of Detergent Amount in Terms of Sulfated Ash Content (Inventive Examples)

<u>Inventive Example</u>	<u>Detergent</u>	<u>Sulfated Ash Content</u>	<u>Amount to be used</u>	<u>Amount in terms of sulfated ash content</u>
Ex. 2	Sulfonate	42.5 mass %	0.8 mass %	0.34 (42.5 x 0.8/100)
Ex. 3	Phenate	31.5 mass %	1.2 mass %	0.378 (31.5 x 1.2/100)

Further, as described above, Nakazato is directed to providing a lubricating composition having a low sulfated ash content of 0.1 to 1 wt %. Accordingly, one skilled in the art would not have been motivated to combine Yagishita, containing very high sulfated ash contents such as 42.5%, with Nakazato, directed at low sulfated ash content, and even the proposed combination with Dasai or Ichihashi would not provide such a motivation.

For at least these reasons, even the proposed combination of Yagishita with Nakazato and Dasai or Ichihashi would not teach or suggest all of the claimed elements, and the results exhibited by the presently claimed compositions would not have been expected by the proposed combination. Accordingly, reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

In view of the preceding Amendments and Remarks, Applicants respectfully submit that the pending claims are patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Application No. 10/800,949
Reply to Office Action of May 2, 2008

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November 3, 2008
(Date)

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Enclosures: Petition for Extension of Time (three-months), Table A

Table A

	Nakazato			Present Inventoin				
	Ex.1	Ex.2	Com.A	Com.6	Com.3	Com.4	Ex.2	Ex.3
Det.A:								
Ca salicylate, Ca:2.1wt%	6.9	-	-	-	-	-	-	-
Det.B:								
Ca salicylate, Ca:8.2wt%	-	1.6	-	-	-	-	-	-
Ca salicylate, Ca:5.8wt%	-	-	-	2.0	2.0	2.0	-	-
Det.F:								
Ca sulfonate, Ca:15.5wt%	-	-	0.93	-	-	-	-	-
Ca sulfonate, Ca:12.5wt%	-	-	-	-	-	-	0.8	-
Ca (sulfurized)phenate, Ca:9.25wt%	-	-	-	-	-	-	-	1.2
Borated succinimide (N content, wt%)	0.06	0.06	0.06	-	-	-	-	-
Borated bis-succinimide (N content, wt%)	-	-	-	0.13	0.06	0.13	0.13	0.13
ZDTP(seoC3-8alkyl) (P content, wt%)	0.03	0.03	0.03	-	-	-	-	-
ZDTP(1,3dimethylbutyl) (P content, wt%)	-	-	-	0.029	0.068	0.068	0.068	0.068
Amine-phosphite (P content, wt%)	-	-	-	0.013	0.025	-	0.025	0.025
Hot tube test Rating (290°C)	8.5	7.0	5.5	8.0	2.5	7.0	7.0	7.0
Four ball wear test								
Wear scar diameter, mm	-	-	-	0.66	0.34	0.71	0.35	0.36
Fresh oil	-	-	-	0.69	0.39	0.79	0.40	0.41
Deteriorated oil (3wt%)	-	-	-					